THE MIAMI CONSERVANCY BULLETIN

DECEMBER, 1923

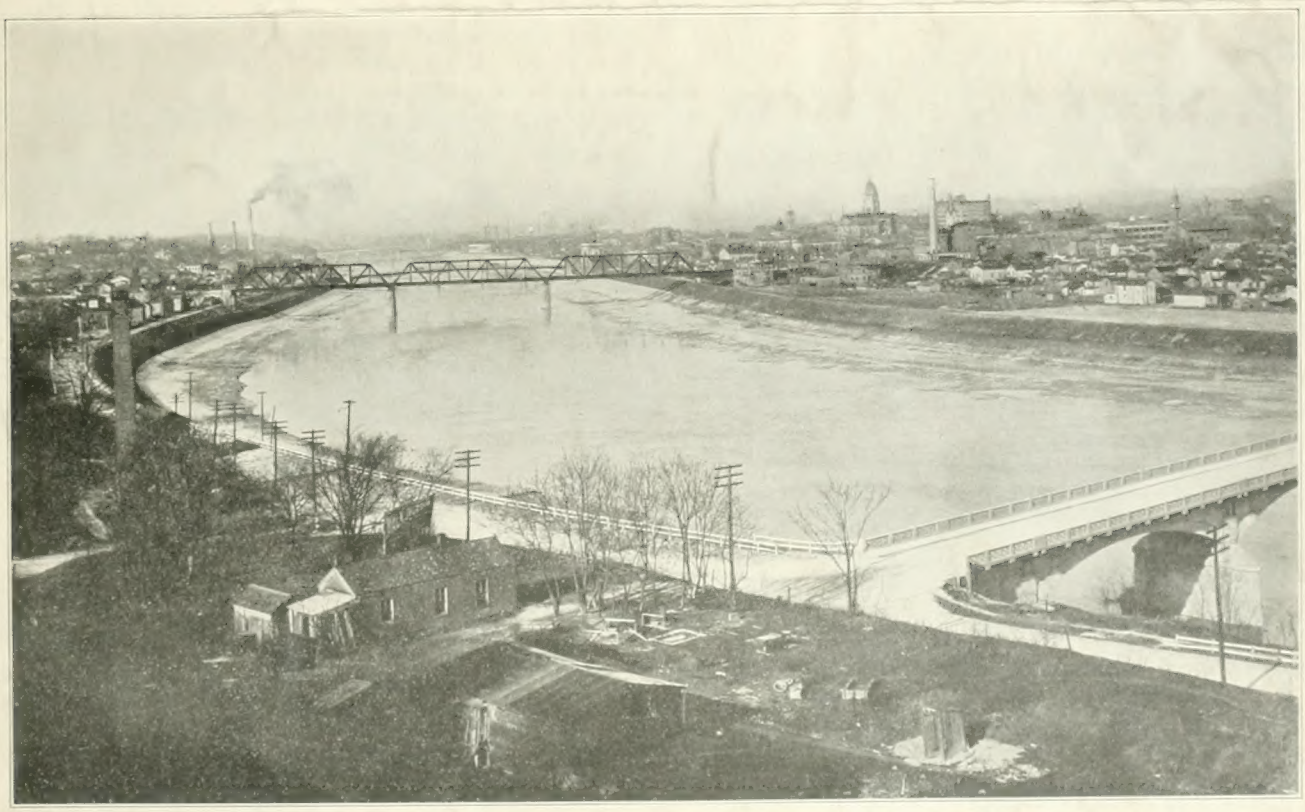

FIG. 396.—VIEW OF THE COMPLETED RIVER CHANNEL AT HAMILTON LOOKING UP-STREAM FROM HILL SOUTHWEST OF COLUMBIA BRIDGE.

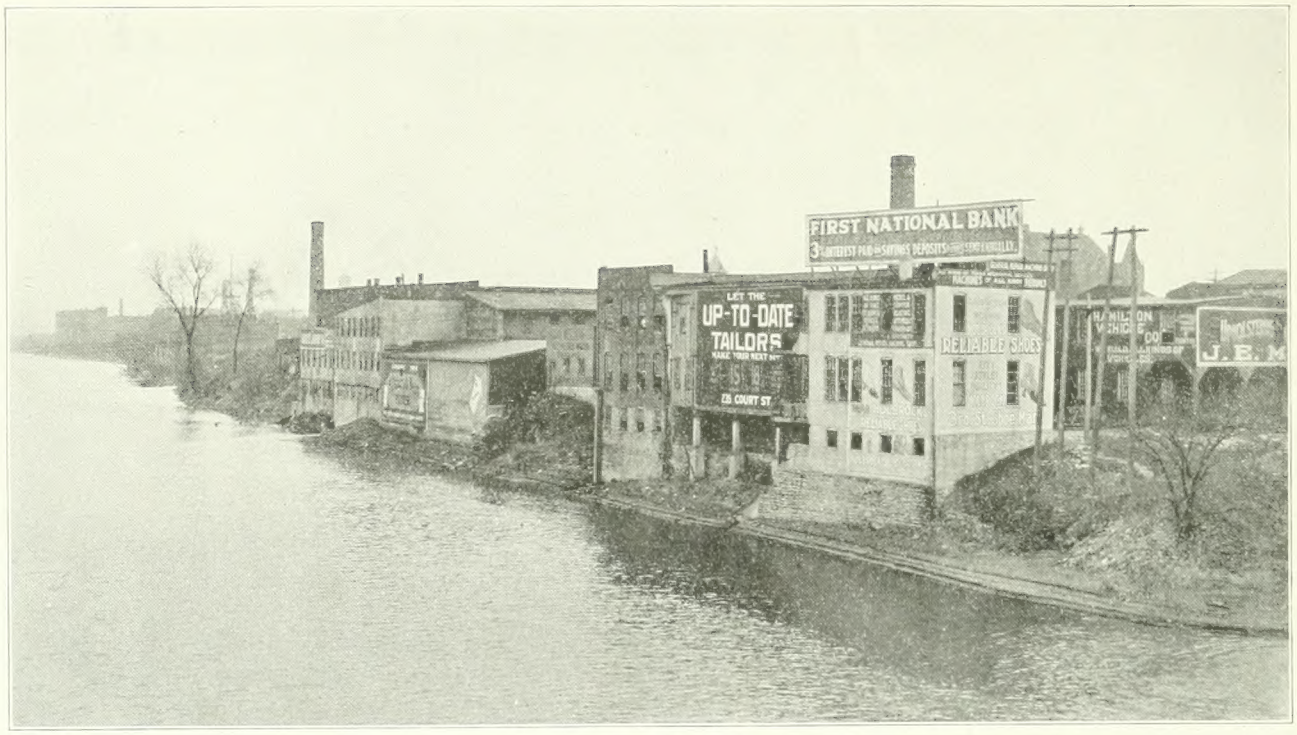

FIG. 397.—THE EAST BANK OF THE MIAMI AT HAMILTON NORTH OF MAIN ST. LOOKING UP-STREAM FROM MAIN-HIGH BRIDGE. APRIL 1, 1918.

Practically all of the buildings shown in this picture were removed in order that the river channel might be widened and that necessary space for the levee and walls be made.

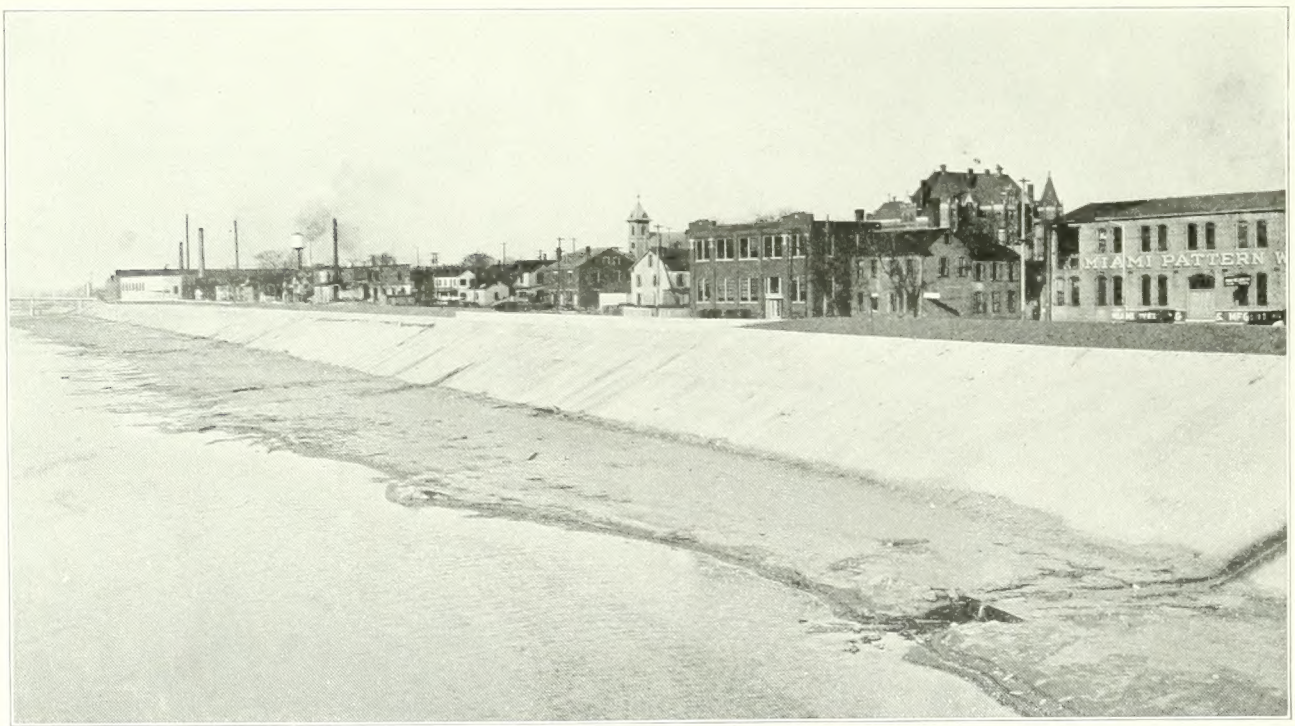

FIG. 398.—THE EAST BANK OF THE MIAMI AT HAMILTON NORTH OF MAIN ST. LOOKING UP-STREAM FROM MAIN-HIGH BRIDGE. APRIL 19, 1923.

This view shows the same section of river front as Fig. 397 above, after all construction work had been completed. The easterly end of the new Black St. bridge appears at the extreme left of the picture. The concrete revetment extends to within four feet of the top of the levee. Flexible block revetment was laid at the foot of the concrete on the slopes.

THE
MIAMI CONSERVANCY BULLETIN
PUBLISHED BY THE MIAMI CONSERVANCY DISTRICT
DAYTON, OHIO

Volume 4 | December, 1923 | Number 5

Index

Final Issue of the Bulletin

This is the concluding issue of the Bulletin. All details of the construction of the District's works for the protection of the Miami Valley from floods have been completed. The District is now on a maintenance basis. Throughout the period of construction this little publication has appeared at more or less regular intervals, its object being to acquaint the public with the work being done by the District and to point out in some detail (in a popular manner) some of the outstanding features of the project. Progress of each of the units of the entire system has been chronicled in the preceding issues, and the purpose of this number is to present a final report on the construction activities of the District. It is hoped that the aim of the Bulletin has been attained; that its readers have gained from its pages a clear, intelligible picture of the manner in which the works have been constructed.

Final Volume of Technical Reports

Part X of the technical reports of The Miami Conservancy District is now in preparation and it is expected that this report will be available for distribution within a few months. It is entitled "Construction Plant and Methods as Used on The Miami Conservancy Project," and is being written by Chas. H. Paul, Chief Engineer of the District. This, the final volume of the series, should be of more than usual interest to both engineers and contractors, especially to those engaged in the class of work on which equipment such as was used on this project can be adapted. It deals with plant and methods on a large scale enterprise, where the various units were widely separated and where the selection of plant for each separate job became a problem in itself.

A separate chapter will be given to the discussion of the dragline excavator as this type of equipment in various sizes was used so extensively on this work.

This report will contain a list of the plant used on each important feature of this large flood control project, together with a description and cost of each item of equipment. Methods and results will be discussed under the various classifications of work, such as rock and earth excavation, concrete, hydraulic fill, transportation, etc., and cost data under various headings will be set down and analyzed.

Concrete Tablets at the Dams

In order that the five dams of The Miami Conservancy District might be properly identified by visitors and tourists large concrete tablets have been erected at suitable locations at each dam.

These tablets are about ten feet square and are supported at each side by massive concrete posts. The inscriptions on each tablet were formed by the use of specially prepared metal letter patterns. Concrete forming the tablets was poured with the forms in a horizontal position, the letter patterns having been placed in the forms first. Special treatment and very careful handling of materials were necessary in order to secure a clean job, as it was quite difficult to pull the letter patterns out of the concrete without chipping the edges.

After the concrete was set the tablets were raised to a vertical position and set in place. The supporting posts were then cast. The final touch was given by filling the letters with black paint. On each tablet is the name of the dam and its length, height, and thickness at the base, also the date of completion. (See page 79.)

Review of the Work at Hamilton

Local Improvement at Southern End of the District Completed in 1923.

The pouring of the last slab of slope revetment on October 10, 1923, marked the end of the construction period at Hamilton. This work was started in the spring of 1918 and required altogether a period of more than five years.

The project at Hamilton consisted mainly of widening and deepening the channel; building levees, retaining walls, and slope revetment. It included also the construction of the Black Street bridge, the Twomile dam, Buckeye Street sewer, Wood Street sewer and Front Street sewer. In addition to and in connection with these larger divisions of the project there were a great number of minor items among which are: the extending or adjusting of about thirty sewer outlets, building 24 gate chambers, public service relocations and adjustments, removal of buildings, etc.

The condition of the channel before improvement was largely as the flood of 1913 had left it. The capacity within the banks was less than 100,000 second feet. Deep holes had been scoured in places and bars formed in others. The banks were irregular and overgrown with brush. The remains of three truss bridges were in the river below their respective sites and added to the obstructions. The channel had been encroached upon by manufacturers and residents along the banks by the erection of buildings and by the dumping of cinders and other waste. Figure 397 shows the condition of the east bank above the Main Street bridge before work was begun. Figure 398 is taken from the same point after the completion of the work.

The narrowest point in the channel was opposite the Sterling Paper Company. The 1913 flood at this point reached an elevation of 607. A similar flood in the improved channel, retarded by the dams, would reach elevation 588.5, a difference of 18.5 feet.

The damage done by the 1913 flood was proportionately greater at Hamilton than at any other city in the District. The maximum discharge was 352,000 second feet as compared with 252,000 at Dayton and 70,000 at Piqua. The flow provided for in the new channel is 200,000 second feet. With the retarding basins in action it will require a flood 40% greater than that of 1913 to produce this flow.

In designing the new channel it was planned to widen, deepen and straighten the existing one. Levees were added to give additional capacity. Revetment was required here to a greater extent than elsewhere in the District on account of the higher velocities, the maximum being about 13.5 feet per second.

At the upper end the improvement terminates at a dam just above Two Mile Creek and Old River. At this point the channel has a bottom width of 800 feet. It narrows down to 620 feet at about Station 9. The width remains constant to Station 15 from which point it is reduced to 540 feet at the north end of the Champion Coated Paper Company's mill. At the south end of the paper mill the width is further reduced to 520 feet. It holds this width to Station 47 from which point it is reduced to 501 feet at the Main Street bridge. South of the bridge the channel widens gradually to 620 feet in a distance of 1000 feet, this width being maintained to the south end of the improvement 8500 feet below the Main Street bridge. From Station 10 to Station 60 the slope of the channel is 0.08 per cent. Below Station 60 it is 0.05 per cent.

Heavy retaining walls were required at both ends of the Main Street bridge and along the Black-Clawson Foundry. Smaller walls were used as substitutes for levees where space was too restricted to permit the use of the latter.

A cut-off channel to straighten the course of Fourmile Creek was dug about 1½ miles north of the city.

The principal quantities involved in the work at

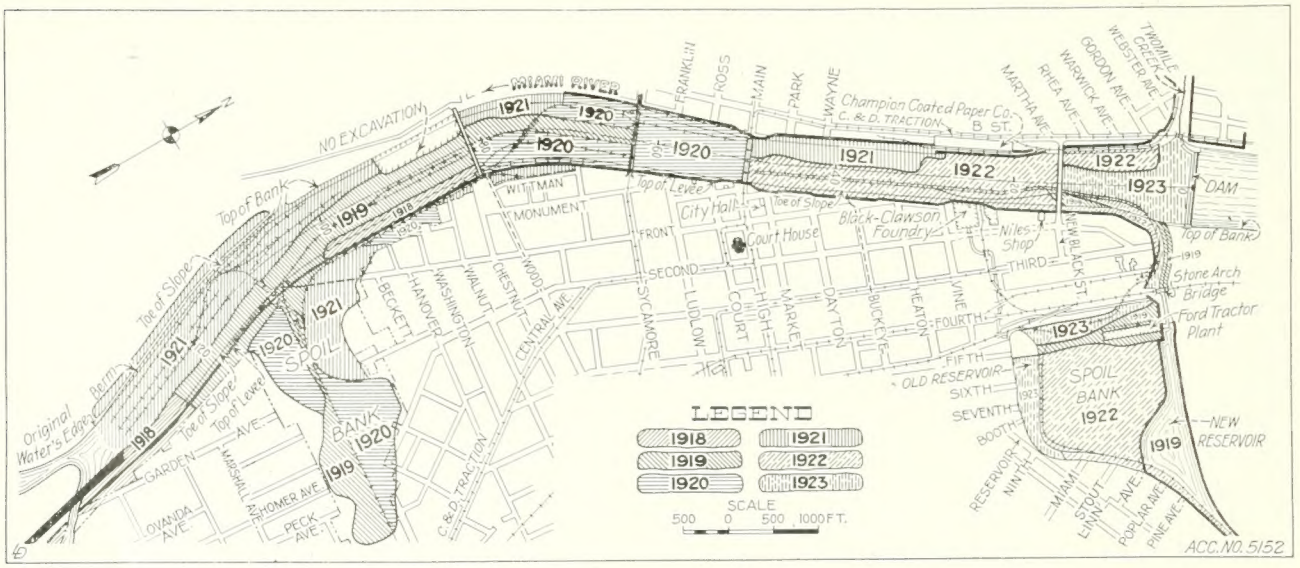

FIG. 399.—PLAT SHOWING THE EXTENT OF THE WORK AT HAMILTON.

The shaded portion indicates where the work was done and progress by seasons of the channel excavation and levee construction is shown. The total length of improved channel is about 2½ miles. Levees or walls were constructed on the east bank of the river from the old river just below the dam to a point about 8500 feet below Columbia bridge.

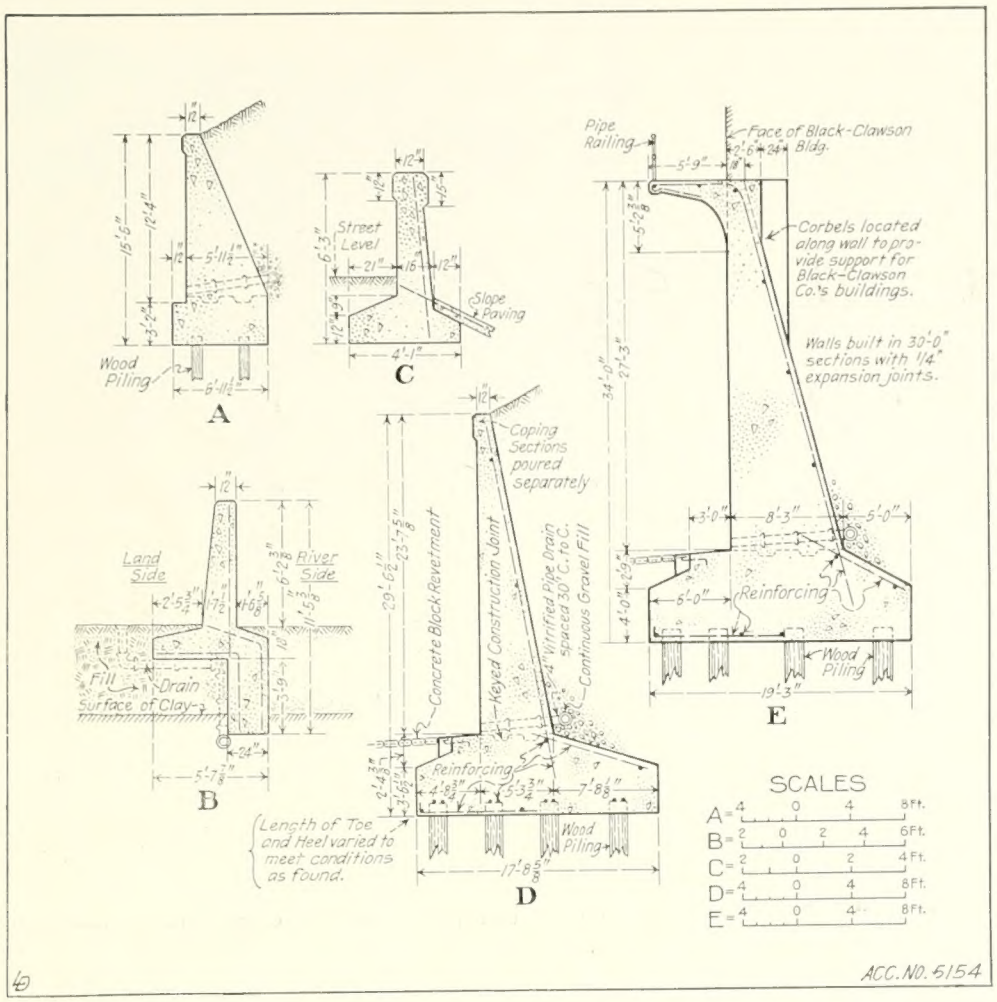

FIG. 400.—TYPICAL SECTIONS OF WALLS CONSTRUCTED AT HAMILTON.

Five types of wall were used. Type A is the usual type of retaining wall without steel reinforcing.

Type B was used in place of levees where space was limited. Where the walls were very high type D was used. Type E was specially designed to provide support for the wall of a building. An overhanging side walk projects on the river side of this wall.

Type C was used along N. Monument Ave., where lack of space prevented carrying the levee to full height. The base of the wall is tied into the slope paving.

Hamilton were:—

Excavation, all classes	2,314,000 c. y.
Levee embankment	379,000 c. y.
Concrete	32,000 c. y.

Excavation

There was a large surplus of excavation which could not be placed in levees so that it was necessary to secure spoil banks for this material. These were two in number as shown on the map. The channel excavation naturally divided itself into two sections, that above the Main Street bridge being taken into the north spoil bank and that below into the south spoil bank.

The equipment used for handling excavation consisted of:—

1—Class 24 Bucyrus electric dragline.
1—Class 14 Bucyrus electric dragline, caterpillar type.
1—Class 14 Bucyrus electric dragline on skids and rollers.
1—Model 21 Marion dragline, caterpillar type.
3 to 5—40 to 50-ton locomotives.
30—12-yard Western air dump cars.
1—Spreader car.
3 to 4 miles—Standard gauge track, 60 to 85 lb. rail and accessories.

The Class 24 Bucyrus was used for most of the channel excavation, being assisted by the two Class 14 machines. The Class 14 on caterpillars was used principally to build levees, track embankments, excavate for bridge piers and retaining walls, drive piling for piers and retaining walls, excavate and drive piling for Twomile dam and dig minor channels. The Class 14 on rollers was used to dig the Fourmile Creek cut-off and to assist on channel excavation. The Model 21 Marion was used to build minor track embankments and small levees, to shift track, unload coal, load topsoil on wagons, clean out under bridges and build roadways and approaches. It was also used as a crane in repairing and dismantling the larger machines. This machine was purchased in time of labor shortage, primarily to shift track but so many other uses were found for it that it was used very little for its intended purpose.

A steam shovel and narrow gauge outfit were used in removing 56,000 cubic yards under contract on the east bank north of Black Street.

A local shop was maintained thruout the work and most repair work was done on the job. Major repairs, however, such as rebuilding dragline buckets, rewinding motors, etc., were made at the District's shop in Dayton.

Connections were made with the B. & O. railroad tracks at South Hamilton, through the Niles Tool Works yard and near North Third Street. Coal, cement and other construction materials, as well as the District's cars and locomotives, were brought to the work over three tracks. All supplies for the Black Street bridge were delivered directly

to the bridge by rail through the Niles yard.

To enter the north spoil bank it was necessary to build an underpass under the B. & O. Railroad. Arrangements were made with the railroad company to drive the piling and build the trestle at the District's expense after which the District's forces made the required excavation. After the work was completed the District backfilled the underpass after which the trestle timbers were removed by the railroad company.

Excavation was started at the lower end of the proposed improvement and progressed upstream. A small channel was first dug around Riley's Island to lower the water through the city thus facilitating the work. The excavation by years as well as the fill in spoil banks is shown on the map Fig. 399.

The excavation was so planned that as a rule the equipment was kept on the higher ground at the sides of the channel during the high water season, the work near the stream bed being done during dry weather. This was not always possible because high water sometimes occurred very unexpectedly as on September 3, 1922, when the rise came so suddenly during the night that the Class 24 dragline had to be abandoned in the middle of the river immediately below the Main Street bridge. At this time the river tracks were badly damaged and the dragline undermined and tilted to one side, but no serious damage resulted to the machine.

When working in the stream with a dragline it was nearly always possible to have a connection with one of the banks so that the machine could move to a safe position in a few hours.

As stated above, one reason for starting the work at the lower end was to have a lower water level through the city. Another reason was the necessity for coordinating the work of excavation with that of the removal of a number of factory buildings on the east bank north of Main Street bridge and also with the construction of Black Street bridge. These jobs required from two to three years and the excavation could not be undertaken until they were practically completed.

The track layout for the excavation is also shown in Figure 399. As the work south of Main Street bridge was being completed, tracks were being laid to the north spoil bank so that the hauling equipment was in readiness when the dragline started work north of Main Street. South of Main Street two trestles were required to make the material on the west side accessible. The decks of these trestles were cabled together and the cable anchored at one bank to prevent their being swept away by high water. North of Main Street bridge no trestles were necessary, most of the material on the west side being placed in the levee, and the remainder cast over to where it could be reached by the dragline from the east side.

Revetment

The methods of laying flexible concrete block revetment as well as monolithic slope revetment were described in detail in previous bulletins. The methods used at Hamilton were similar, with the exception that where the revetment extended high on the banks the upper slabs were poured from the top of the slope. Pouring from the bottom with a dump bucket running on a boom was a more satisfactory method where it could be used. This was true for the reason that it was necessary to use a mix dry

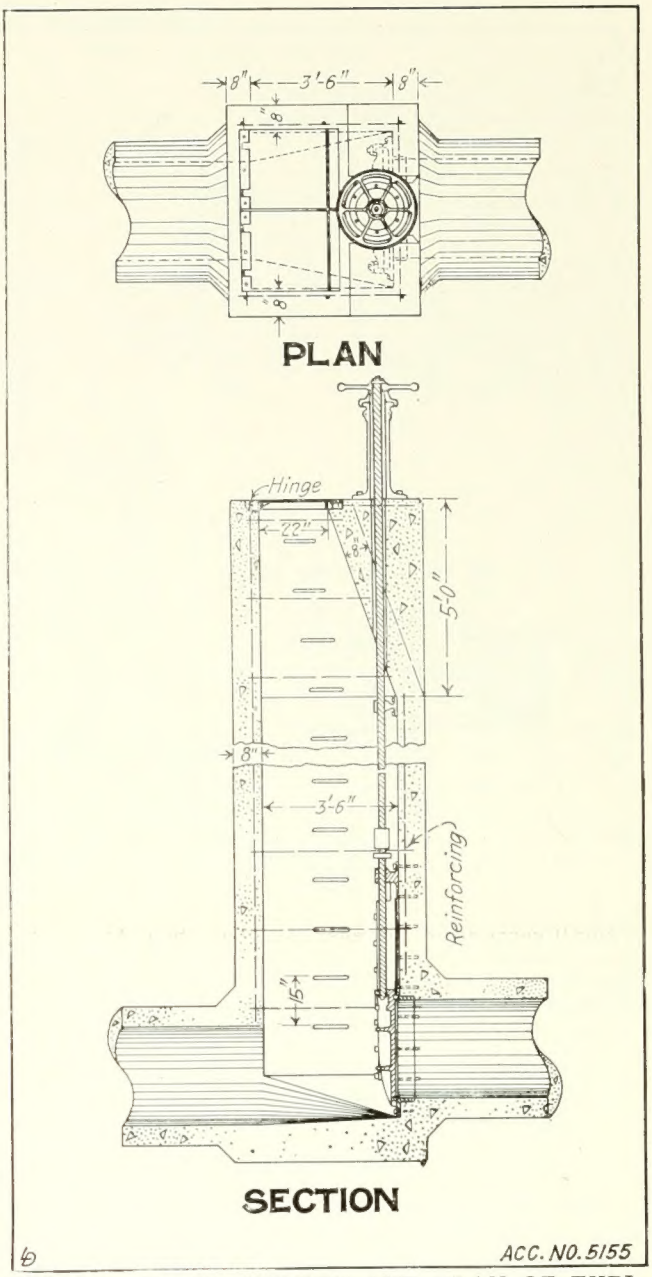

FIG. 401.—CROSS SECTION AND PLAN OF TYPICAL SLUICE GATE CHAMBER.
The gate is operated by turning the hand wheel at the top.

enough to stay in place on a 2:1 slope. The proper mix for this purpose was a little too dry to run well in a chute.

On the east side of the channel north of the Main Street bridge the revetment reaches to within four feet of the top of the levee and extends to the mouth of Old River. South of the bridge it extends to the railroad bridge and reaches an elevation 14 feet above the toe of slope. On the west side the top of the slope revetment is 6 feet above the toe of slope and extends from Twomile Creek to the Columbia bridge. Flexible block revetment was used within the same limits as the slope revetment, the width varying from 20 to 35 feet.

All of the revetment work was done by Price Brothers Company, of Dayton, under a cost-plus-variable-fee contract which proved very satisfactory to both parties. Materials were furnished by the District, the contract covering labor only.

FIG. 402.—CONSTRUCTION ACTIVITIES AT HAMILTON.

In the foreground is the concrete mixer pouring slope revetment two slabs high, each slab being 13.5-ft. on the slope. In the center is a dragline loading cars. At the right is the Black St. bridge.

The first season's work on revetment was done in 1920, the section on the east side below Main Street being laid at that time. During 1921 revetment was laid on the west side from Columbia bridge to the Champion Coated Paper Company's mill. The remainder of the revetment on the west side and west of that on the east side north of Main Street bridge was laid in 1922, a small amount of work being left over at the extreme north end on the east side. A small section on the east bank south of Main Street bridge had been previously omitted on account of the District's shop projecting over the bank. This was completed in the fall of 1923 as soon as the shop had been removed.

It was not practicable to work on the revetment during the high water season as lower parts of the slopes were often submerged.

At the west end of the Main Street bridge the revetment reaches a lower elevation than at any other point, this elevation being below low water level. The Marion Model 21 dragline was used to build an earth cofferdam around this section and the site was unwatered by a centrifugal pump with 4″ discharge. This work was done by the District's forces, the contractor handling only the revetment.

Walls

Five types of retaining walls were used. Figure 400-A is the plain gravity type which was used for retaining earth fills up to a height of 12 feet. Figure 400-B shows a type of wall used in place of a levee when space was limited. It is reinforced against water pressure and has a cut-off going down through the gravel to clay. No coping was used in this case as the wall is in a location where the additional expense for the sake of appearance was not warranted. Drains are provided under this wall to prevent upward pressure on the base. The third class of wall, Figure 400-C, was used along N. Monument Avenue where a levee would have taken up too much of the street. As it is in a conspicuous location and can be seen from both sides, a coping is provided on each side. The river side of this wall is connected by reinforcing to the slope revetment which at this point reaches the base of the wall. The river walls at the Main Street bridge and the wing walls at the Black-Clawson foundry are of the type shown in Figure 400-D. This is known as the semi-reinforced type. The flexible block revetment is fastened to these walls by steel hooks spaced 1 foot apart and placed during the pouring of the wall. The Black-Clawson wall is shown in Figure 400-E. It is of the semi-reinforced type but differs from the other river walls in that it supports a cantilever side walk and carries the west wall of the Black-Clawson foundry buildings. During the construction of this wall the west portions of the buildings were removed and temporary wooden ends placed east of the excavation. After the completion of the work the west wall of the buildings was rebuilt of brick on top of the river wall.

For the larger walls excavation was made by a Class 14 Bucyrus dragline where there was room for open excavation. Where sheeting had to be resorted to a stiff-leg derrick with clam-shell was used. For the Black-Clawson wall this derrick was mounted on railroad trucks which ran on a track alongside of and parallel to the excavation.

Pile driving for the foundation of the larger walls was done with leads hung from the derrick or dragline boom, steam for the hammer being supplied by the derrick or dragline boiler.

Concrete was mixed in a ½ yard Smith mixer and wherever possible was chuted directly into place. Where this could not be done it was placed with bottom dumping buckets handled by the derrick.

Sectional wooden forms of two-inch material were used. Forms on the larger walls were held together by ¾-inch rods secured by Universal form clamps and covered with tin tubes to facilitate their removal.

A number of sewer outlets had to be extended or rebuilt to make them conform to the revised alinement of the banks. These ranged in size from small pipes to 5 foot circular concrete sewers. In most cases they were adjusted so as to discharge on the concrete revetment. On the 36″ sanitary sewer at South Ave. a submerged outlet was constructed extending about 100 ft. into the river.

All sewers which have street or surface openings below the high water level are provided with gates, the smaller ones being of the automatic or flap-gate type while the larger ones are sluice gates operated by hand wheels or wrenches. The sluice gates are in most cases placed in gate chambers built in the levees. A detail of one of these is shown in Figure 401.

The construction of the Black Street bridge, the relocation of hydraulic canal, the Buckeye Street, Wood Street and Front Street sewers, the conduits under the B. & O. bridge at Old River and the Two-mile Dam were major parts of the work, all of which have been described in detail in previous issues of the Bulletin.

The cost of the work at Hamilton, not including property rights, was $2,645,000.

Index for Volumes 3 and 4

An index for Volumes 3 and 4 of the Bulletin is now available. This covers all issues from August 1920 to December 1923, both inclusive. A copy of this index will be mailed free to any readers who desire it. A limited supply of the index for Volumes 1 and 2 is also available for distribution.

Progress of Sales of Equipment

Remarkable Demand for Construction Plant Used on District Work.

Total sales of equipment, supplies and buildings, including salvage from the public service relocations, have reached the impressive sum of nearly one and a half million dollars. Despite the fact that 1923 was a somewhat quiet year in the construction field, over $600,000 has been realized by the District on sales of equipment and supplies. Dragline excavators were the largest single pieces of equipment used on the job. These machines are very expensive and it might be supposed that in a slow construction period the demand for equipment of this class would be quite limited. Yet eleven draglines were disposed of between January and November, 1923, at a total return of $195,000. The entire remaining supply of dump cars, 98 in all, was sold this year, bringing in $97,920, or nearly $1000 each. Locomotives of various types brought $98,000; fourteen locomotives were sold in eleven days early in the year. Pumps and motors sold to the amount of $32,300, and dredge pipe, $14,000.

The items mentioned above had a total sale value of $407,300, which leaves about $193,000 as the amount realized from the sale of miscellaneous small supplies and equipment during the year. In this class are small tools, hotel and restaurant equipment, plumbing supplies, hardware and builders supplies, boiler and engine parts, electrical supplies, drills, motor trucks, concrete machinery, transformers, derricks, engineering equipment, office furniture and miscellaneous merchandise.

None of this material was given away; neither was it priced at an unreasonable figure. Every item, even such small ones as bolts, nails, buckets, coat hooks, was counted, classified and priced in accordance with the fair retail market value of the goods. In fixing the prices original prices were obtained and compared with present-day prices as secured from retail merchants, jobbers, or manufacturers, the depreciation from age was considered, and a fair price finally established. All prices on equipment were reviewed and approved by the Chief Engineer before they were finally set. All selling was done from these fixed prices. Most of the small supplies and equipment were sold at the District's warehouse in North Dayton.

In order to properly bring before the public the class and quantity of goods offered for sale resort was made to advertising. Supplies, automobiles and trucks, and small equipment were advertised in the local newspapers. Larger and specialized equipment was brought to the attention of contractors and engineers through the medium of the technical press; such publications as Engineering News-Record and Electrical World. Some equipment was sold through authorized equipment dealers at specified commissions ranging from 3% to 10% of list price. However the amount sold through these dealers was a very small portion of the total volume of sales. At intervals sales catalogs were printed, listing quantity, kind and prices of all equipment and supplies ready for disposal. These lists were mailed to a selected list of prospective purchasers. Whenever inquiries were received by mail regarding material for sale they were followed up until the sales were made or it became evident that none could be made.

Equipment was sold for shipment to all parts of the United States. One shipment, which included three dragline excavators, filled 28 freight cars and freight charges alone on this equipment amounted to $35,000. The W. E. Callahan Construction Company, of Dallas, Texas, which has the contract for a large reclamation project in the Sacramento Valley in California, was the purchaser of this outfit. Another large sale was made to the Ambursen Construction Company, of New York. This company is engaged in the construction of a dam in Arkansas, and it took $80,000 worth of used Conservancy equipment to this job. The Carterville Fuel Company, Herrin, Illinois, bought a dragline and other equipment for use in its strip mine. East, west, north and south the sturdy equipment which handled the work here is being sent for duty in other fields. Twenty-five carloads were shipped in the first two weeks of July.

The District operated its own shop during the entire construction period. Here repairs and renewals were made to equipment by men who were fully competent and acquainted by experience with the types of machines on which they worked. As part of the plant was released due to gradual completion of various units of the job, the plant used on the completed units was immediately inspected and repaired, either in the field or at the central shop. The plan was to make every machine whole in every respect, and ready to be put to work the day it was unpacked by the purchaser. This policy has been followed since the completion of the job and until every piece of equipment worth selling has been completely overhauled and repaired the shop forces will be busy. The wisdom of this policy has been demonstrated. Equipment has been bought and paid for by contractors a thousand miles away who have not seen their purchases until they unloaded them from the cars at their destination. Not a machine has come back. Exceedingly few complaints have been heard, and all of these have been satisfactorily adjusted.

Another feature that appealed to prospective customers was the fact that they were given the benefit of the knowledge and experience of the District's staff of engineers and construction men in planning their needs. Due to the fact that numerous odds and ends of construction work remained uncompleted until the 1923 season, many of the men familiar with the equipment were on the job until late in the year. These men were at all times ready and willing to consult with a prospective customer regarding the best and most economical type of plant to do his job. If it developed that the District did not have the particular type of equipment best suited to a certain job no attempt was made to sell the customer and he was frankly advised to look elsewhere.

There is now in preparation a new sales catalog which will list all the supplies and equipment remaining. It is expected that by the middle of 1924 the "house cleaning" will be completed and in consequence the construction cost of the job will have been reduced by some two million dollars.

The Conservancy Lands

How the Farm Lands in the Retarding Basins Were Rearranged.

By S. Graham Smith, Farm Manager

The real estate end of the Conservancy work has not been altogether an insignificant item, as the District purchased a little over 33,000 acres of farm land and hundreds of parcels of town property. This might all be roughly divided into four classes:

A. Real estate bought for channel improvement and local protection in and about the cities of the valley.

B. Lands purchased for the necessary relocation of railways and highways.

C. For the erection of the dams—including the land on which they were built, the ground used for borrow-pits and that immediately adjacent.

D. Lands in the retention basins on which the District required the right to flood, to police and remove drift if thought advisable and to control the elevation of buildings.

Certain parcels, of course, would be included in part in all three classes B, C, and D, in that parts were required for the reasons given under the different heads. The necessity for the purchase of lands of classes A, B, and C, is easily understood; the situation in regard to class D land possibly should have further explanation.

Each farm located in a proposed retention basin was a problem which had to be considered individually, depending to what extent, or degree, it might be affected by backwater from the retarding dam at times of floods.

Some were so low, in relation to the dam, that annual, and at times, deep flooding was certain, not only on the fields but over the buildings—and possibly containing no high land to which the farmstead might be moved. Others were so situated that the buildings and almost all of the farm were entirely out of the basin, leaving affected but a small, unimportant area, perhaps a little ravine, practically worthless anyway and even this part so high that backwater would not be expected once in 200 years; and between these extremes all in regular gradation. In the case of farms which contained land high enough and otherwise suitable for building sites, and which sites would not be needed for building locations for other land not so provided, the owners were offered two propositions; either to sell to the District a flood easement, for a stated sum, or to sell the land outright; the flood easement to include the right to subject the land to backwater flooding, to police, etc., and to control the elevation of all buildings.

There are above the dams about 55,000 acres in farms, parts or all of which could be affected by backwater, and of this total the District bought the fee in some 30,000 acres and flood easements on the balance of 25,000.

It must be understood that there are not actually 55,000 acres which could be submerged by backwater, but approximately this area in affected farms. Only small parts of some of these are within the basins and these parts, as explained above, in many cases will not be overflowed unless there should be a flood forty per cent larger than that of 1913. The total area actually subject to overflow in a maximum flood is 35,600 acres. Even the fields in the lower parts of the basins, subject to deep and relatively frequent flooding, are not materially changed as to their use, as very few floods occur during the growing season and even alfalfa and wheat have been subjected to submergence by backwater for many days in winter and early spring with benefit to both the growing crops and the soil. Floods of medium magnitude, which would be considered very small compared with the great one of 1913, are of rare occurrence when considered as a factor affecting the use of the basin lands for agriculture. The flood of March 1898 which, with the exception of that of 1913, was the largest in the last 57 years, would have covered little over a quarter of the lands in the basins had the dams been in operation.

Out of the land purchased, new farms have been laid out where necessary and buildings moved to high sites. The rearranged farms are being sold, subject to flood easements, and up to the present about one-half of these Class D lands have been sold.

The creation of the retention basins affected practically two towns only, Tippecanoe City in Miami County, a small part of which was in the Taylorsville basin, and Osborn in Greene County in the Huffman basin. The situation at Tippecanoe was taken care of by levee protection for the more important and valuable properties affected, and the purchase and removal of houses from those which were not worth the cost of protection. The town of Osborn, however, was entirely within the Huffman basin, the site being from five to fifteen feet below the spillway level of the Huffman dam. As all railroads, two steam and one electric, were relocated a distance of a mile and a half from the old locations passing through this town, the place would have lost most of its reason for being anyway, so that the cost of protection would have exceeded the value protected. The District bought all the realty in the town.

Near a new station planned for the two relocated steam roads, and also close to the new location of the electric line, was a nice, level piece of farm land belonging to the District which was quite suitable for a town site. It was planned to take this into the Osborn corporation, move the town over and maintain the corporate existence and to a large extent the original "personnel" of the village.

The new site, with a connecting strip to make it contiguous, was then annexed to Osborn, a local, private corporation was organized and capitalized sufficiently for the project. This corporation purchased from the District the land comprising the new site and the buildings in the old town, contracted the moving and relocation of the houses and has been selling and moving to such an extent that now the old town is almost all on its new location and the properties back in the hands of private owners. In addition to the frame buildings moved over from the old town site, many new buildings have been erected; dwellings, stores, a bank, a grain elevator, and municipal water plant. What was an unbroken field of grain a few years ago, now is a going town, served by three railroads with their sidings, switch tower and stations, streets curbed and electrically lighted, water system and everything needed for the comfort and convenience of the

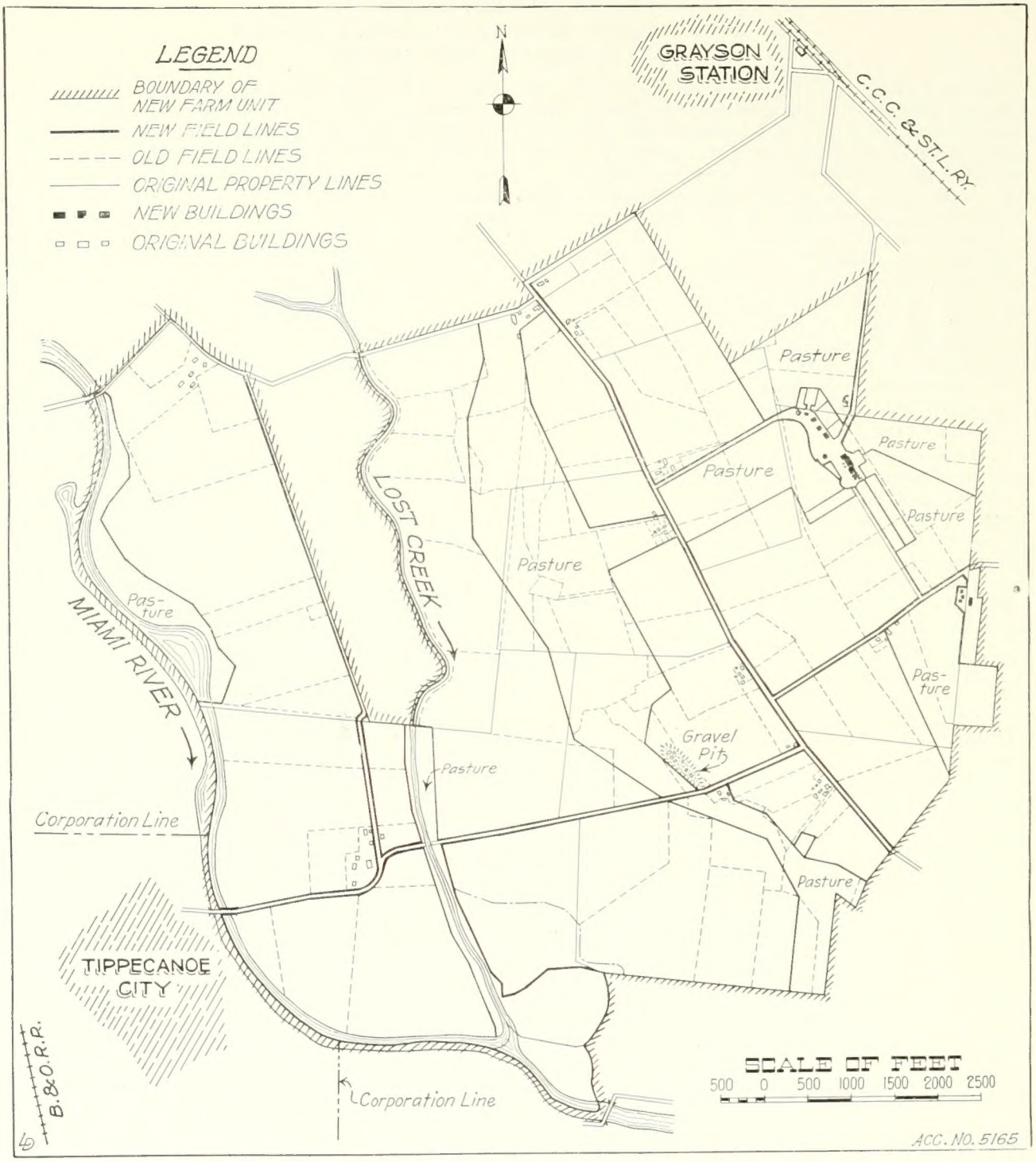

FIGURE 403.—MAP OF TRACT NORTHEAST OF TIPPECANOE CITY IN MIAMI COUNTY, KNOWN AS TAYLORSVILLE OPERATING UNIT NO. 1.

citizens and their economic and political life.

Figure 403 illustrates the necessity for the purchase by the District of much of the land which for the purpose of this article is called Class D. While this case is exceptional in that this new unit, or farm, is the largest in the whole project, it shows why it was not possible in many cases for the individual farm owners to sell flood easements and retain their farms.

Contained within this tract are about 1400 acres, made up of twelve farms purchased by the District from twelve separate owners. There are on the whole 1400-acre tract but two locations high enough for buildings—a rather small knoll near the middle of the east line and a gravelly ridge some 2000 feet northwest of this knoll. On the small elevation first mentioned has been relocated a medium sized set of farm buildings; a dwelling, barn, crib, hog-house and small outbuildings, but on the larger ridge is the main farmstead for this unit.

Both of these elevations were on the same farm. As eleven of the original farms contained no ground

high enough for building sites, one can readily see how it would have been impossible for the owners of these eleven properties to have adjusted the matter on any other basis than an outright sale. And without the purchase of the twelfth farm, having the two sites, no suitable farmstead could have been provided for the others.

Now—while this new farm unit is, of necessity, larger than the average farm, and the buildings are farther from some of the fields than were the original buildings on the smaller farms, considered only as an industrial plant for producing grain, hay, live stock or milk, the net costs of production will be less than before the change. The new main farmstead is located much nearer a shipping point (Grayson Station), with elevator and stock loading pens, than the average of the twelve original farms. It includes four dwellings which, as they are reasonably close together, are provided with hard and soft running water, modern plumbing and electric lights and power, all water supplied from one central plant. As these residences are, in all ways, much more desirable than the average farm house, the farm labor situation is much improved. There is a bank barn with over 15,000 square feet of mow floor, and an equal area of well lighted basement for live stock. This is connected, by an inclosed passage, with a modern granary supplying storage for 32,000 bushels of ear corn and about 13,000 bushels of small grain—all grain put in by modern dump and power elevator and withdrawn by gravity through bottoms of cribs and bins right into wagon, truck or feed carrier. On the south side of granary, and close enough to spout the feed into feed-room, is an up-to-date farrowing house for hogs, well drained, sunny and convenient. This farmstead has also a large, bank machinery storage with basement work shop equipped with forge, power grinders, saw, etc. All buildings supplied with running water. The cost of installation and maintenance of these conveniences and the same labor saving equipment on twelve separate farms would have been thought prohibitive.

The twelve original farms were divided into eighty-one cultivated fields of an average size of 11.2 acres. The new farm has only twelve fields of an average of 85 acres each. The average length of the original fields was 884 feet; the new fields average 2762 feet long. In all cultural operations, plowing, disking, harrowing, rolling, planting, cultivating and harvesting, one must turn at the end of the field, of course. This lost motion of turning is reduced in the new field lay-out to less than one-third of what it was in the old. It requires less labor per acre for all field operations and less labor per bushel after the grain is brought in; also less labor per head of live stock than on the original farms. On this new farm, as on the others of the District's where the buildings have been located on the highest side, the stable and yard manure is produced near the land that needs it the most; the more distant fields being first-bottom are better able to produce good crops without manure.

The overflow feature is negligible on this farm as the lowest field will probably not have backwater from the dam oftener than once in ten years. The abandoned sites of the old farm buildings should expect backwater only once in fifty to eighty years. The soil however is naturally of a superior type, level and rich. It has been kept up in quality and is being constantly improved, but one could not depend upon the silt deposit from backwater overflow to maintain fertility as on some of the other lands in the District.

As already explained, the large farm above described is used here as an illustration of the necessity for the purchase and rearrangement of much of the farm land, and is an extreme case as to size. Most of the farms as rearranged which have been sold, and which are still for sale, are only of medium area, and in regard to probability of backwater overflow vary from those of which some fields will have almost annual overflow to those of which no part will probably be affected by backwater once in a lifetime. The low, first bottom land forming the flood plain of the streams was subject to overflow before construction of the dams, and was always in some danger of damage by either scour or gravel deposit caused by currents of high velocity. The first bottom land which lies not too far above the dams is forever protected from rapid currents and while overflow will be deeper and hence cover larger areas and in some cases continue for slightly longer periods, the frequency is not necessarily materially increased. In the case of the bottom lands in the basins which lie quite well up stream from the dams conditions will not be changed by the dams except at times of big floods when, of course, currents will be checked as soon as the backwater reaches them.

The overflow matter is working out just about as it was forecast before completion of the dams. There has been no backwater so far during the corn growing season and silt deposit has been at least as much as was expected. There has been received but one complaint from a purchaser of one of the District's farms on account of backwater overflow and this was that he was not getting as much as he had hoped for.

The fact that most of the farm land already disposed of has been sold back to local farmers, much of it to members of the same families from whom the land was bought, and that there is no hesitation on the part of insurance companies, banks and building and loan associations to loan money on Conservancy land, is the best of evidence that the net effect of the retarding dams is, at least, not injurious.

While, as above stated, about one half of the Class D land has been sold, the District still has something like 15,000 acres for sale. This land is divided into farms of from 75 acres to 1400 acres and at the present time blocks of contiguous farms could be sold up to 6000 acres—and these containing the best land in the best part of the Miami Valley.

River Conditions in 1923

From a meteorological standpoint the year 1923 was one of few extremes, except perhaps with respect to rainfall. Up to December 1st the accumulated deficiency in rainfall amounted to 6.40 inches; the late summer and fall months were unusually dry. However, the year ended with a total rainfall for the 12 month period that was nearly up to normal, as December was a very wet month. According to Weather Bureau records at Dayton 6.84

(Concluded on Page 81)

Finishing Touches Made in 1923

Review of Construction Work Done to Wind Up the Big Job.

While the dams were completed by the end of the 1922 season and most of the local protection work in the towns was done, there remained numerous small jobs and finishing touches which could not be handled until the big work was out of the way. The construction forces got busy on these early in 1923 and at the time this is being written it can be truly said that the construction of the works of the District is entirely finished. This is said with considerable satisfaction for it is a well known but ever surprising fact that finishing a job after the hard part has been successfully accomplished always takes longer than was anticipated.

Work done at Piqua this year consisted in finishing the levee on the right side of the river below the Shawnee bridge; in cleaning up the grounds and removing the buildings north of the Rossville Bridge and east of Main Street; and in completing the surface dressing and grassing of the levee slopes. Property line survey work was also completed.

At Troy the track elevation and levee construction along the Troy and Piqua branch of the B. & O. Railroad at Morgan Ditch was started during the summer and completed in the early fall. This work completed the levee system in Troy. The roadway on the Adams Street bridge and the approaches were paved; concrete was used for the bridge pavement. The city of Troy constructed a low concrete dam across the river just below the B. & O. Railroad bridge. This was done with the permission of and according to plans approved by the District.

The principal item of construction at Tippecanoe City in 1923 was the completion of the new water pumping and electric power plant. A new building to house the plant was erected just inside the levee and north of Plum Street. Part of the pumping equipment from the old plant east of the canal was removed to the new building and some new plant units were installed. This work took considerable time and it was not until early in December that the new plant was in full operation. At the east end of Broadway, near the levee, a small sewage pumping station was constructed. The pumps and motor are housed in a neat brick and concrete structure. This plant will be used during high water to keep sewage from backing up when the flood gates are closed.

The only construction work undertaken at Dayton was the removal of the gravel bar in the Miami River at the mouth of Wolf Creek. This work had been held in abeyance pending the completion of a concrete barrier near the mouth of Wolf Creek. The purpose of this barrier is to check the drifting of gravel into the river and also to maintain the difference in grade between the creek channel and the river bed.

All work in the towns of West Carrollton, Miamisburg, Franklin and Middletown was completed by the end of 1922, except the construction of the Third Street sewer in Miamisburg and a few flood gates at Miamisburg and Middletown. This work was done early in 1923.

At the beginning of the year more work remained to be done at Hamilton than at any of the other towns. A considerable quantity of channel excavation near the upper end of the job was completed early in the year. The levee along Twomile Creek was finished and necessary paving and sidewalks laid where B Street crosses the levee. The temporary underpass at the B. & O. Railroad bridge was filled in and the tracks removed. All concrete revetment work on the east side of the river at the upper end was finished up, along with the revetment at the end of the barrier dam north of Twomile Creek. Necessary repairs were made to the concrete apron of this dam. The shop and office buildings on Monument Street were removed and the levee and revetment at this point finished. The balance of the top soil was placed on the levee slopes and the slopes were seeded. All flood gate structures were finished and the gates were set.

Maintenance of the Flood Prevention Works

Outline of Work Necessary to Keep System Ready for Next Flood.

By C. H. Eiffert, Maintenance Engineer

The maintenance problem consists in keeping in perfect working condition a system which may not function to its full capacity during the next 100 years. A flood of the size requiring control is likely to occur not oftener than once or twice in a lifetime. However no one can foretell the time at which such a flood or a greater one will occur, therefore the protecting system must be ready for it at all times.

The dams and other works built by the District are of great stability, nevertheless, constant weathering and deterioration are taking place. Frost action loosens the surface material on the slopes of dams and levees and rain water washes gullies, small at first, but if not repaired, increasing in size, until they become a menace. Persons walking up and down the slopes in the cities cause more damage than one would think, ground hogs make holes in levees and small boys dig caves in the banks. Residents adjoining the District's property have a tendency not only to dump garbage, tin cans and other refuse on the slopes, but to encroach by building fences, sheds and other structures on the District's land.

To attend to such matters caretakers have been appointed at all dams and at cities where the District has built levees or made channel improvements. These men are in effect, custodians of the District's property. With necessary help the caretakers in the cities cut weeds, clear out brush, inspect levees, channels, sewer outlets, flood gates and revetment. They also read gauges, report accidents and look after the sale of gravel. At the dams their duties are less numerous but no less important. They must inspect the dams and outlet structures daily and the reservation weekly. They cut weeds, repair washes in the slopes, grade the roads over the dams and keep drains and gutters open. They also read the gauges, report accidents, etc. The

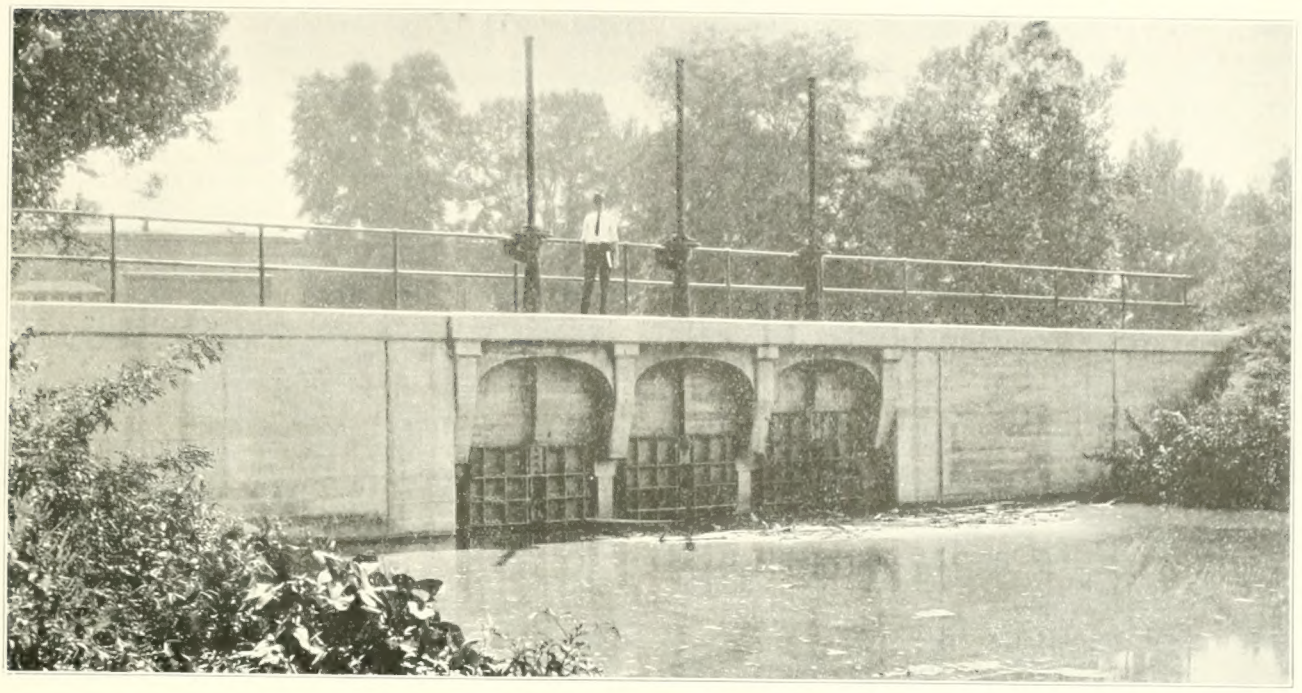

FIG. 404.—FLOOD GATES AT FRANKLIN.

These gates are in the head race of The American Writing Paper Co. They are each 6-ft. by 7-ft. The gate structure is in the line of the levee and is built into the levee at each end.

caretakers at the dams are furnished with houses and land for farming purposes as all of their time is not required on District work, but they must be near at hand, subject to call at any time. Caretakers in the cities spend all of their time on District work.

One of the duties of the caretakers in the cities will be to maintain and operate flood gates. These gates have been placed in sewers and canals to prevent water from backing into the cities in times of flood. They vary in size from 6 inch flap gates to 96 inch sluice gates.

A set of large sluice gates in the head-race of the American Writing Paper Company at Franklin is shown in Figure 404. A cross section of a typical gate chamber, such as were built on most of the larger sewers, is shown in Figure 401.

There are about 220 gates in all, 150 of them being sluice gates. The flap gates are of course automatic in their action and require only to be painted occasionally and to be kept free from obstructions. The sluice gates must be closed by hand at the proper time. A list of gates has been provided for each caretaker showing the gauge heights at which they must be closed. During high water the gauges must be watched rather closely so that the gates will be closed at the proper time. As it may not be necessary to close some of the gates for years, they will not be in usable condition unless they are tested at frequent intervals and are kept properly lubricated and painted.

To prevent erosion and scouring, the levees throughout the towns were seeded during the construction period with red-top blue grass, timothy, sweet clover, alfalfa and other grasses, those kinds being used that were thought to be best adapted for the special soil and slope conditions in each particular case. Satisfactory results were obtained, yet there are numerous places where a good stand was not secured due to unfavorable weather and soil conditions and such places have been and will be reseeded until a good growth is obtained on all the levees. The intention is to eventually have a blue grass sod on all the slopes. At the present time however some of the gravelly soils are not adapted to blue grass and will have to be built up by the use of sweet clover and alfalfa. Some of the levee slopes were covered with top-soil and the results obtained appear to justify the additional expense.

All levees must be patrolled and carefully inspected during high water to detect any seepage, scouring or other signs of weakness. The caretakers also form the nucleus of an emergency force for flood fighting and repair work.

On the slopes of the dams, which consist mostly of gravel, experiments were made with many different varieties of vegetation. Some of the grasses used were brome grass, timothy, red top, Canada blue grass, Kentucky blue grass, sweet clover, Japan clover, wild bunch grass and others. These were planted in various combinations with or without nurse crops and at different seasons. There were also plantings of honeysuckle vines, roses, horse tail ferns, Boston ivy, sumach and St. John's wort. On the Germantown dam which was first to be completed, more than 40 different plots were laid out and planted. The results were closely observed and applied in later plantings. Up to the present time sweet clover and alfalfa have proven to be the best cover for the gravel slopes that can be obtained quickly. Honeysuckle has done very well where planted with a shovelful of top soil to each plant but has not yet made a dense cover such as is required to entirely prevent erosion. All of

the dams now have a fairly good stand of sweet clover with a mixture of alfalfa, timothy and other grasses in various proportions. It is believed that in the course of a few years the soil will be enriched sufficiently so that a sod may be obtained.

The gravel roadways over the dams have become county roads. It is however necessary for the District to keep the gutters and drains open, for clogged drains would cause the gutters to overflow and wash gullies in the slopes. It is probable that the roads over two or more of the dams will be paved by the counties in the near future. This will eliminate some of the maintenance work as in connection with the county paving the gutters will be paved by the District.

Another and important function of the maintenance organization is to make an intensive study of floods as they occur and obtain accurate measurements of discharges in outlet conduits and improved channels. In this way it will be possible to check the design of the system. The floods against which the protection works are of the greatest benefits are the large floods which occur at greater intervals of time and of course the data on such floods is of proportionately greater importance. Not knowing when such floods will come, the maintenance organization must be ready at all times to meet any emergency. This is much more difficult than if such an emergency occurred, say once each year.

At all of the dams and four of the cities rain gauges have been established, some of them in cooperation with the U. S. Weather Bureau. The rainfall is measured daily by the caretakers. By means of the rainfall and stream measurements reliable runoff data will be secured.

At Taylorsville and Englewood the reservations in connection with the dams are wooded and of such a nature that many fine camp sites exist. The roads passing these reserves make them easily accessible for tourists and campers. A patrolman has been appointed at each of these reserves for the summer months. His duties are to cut weeds and brush, dispose of fallen trees, and to clean up and supervise camping grounds. The other dams are not so favorably located for camping purposes. Persons who wish to camp more than one day on these reserves are required to obtain a written permit from the Chief Engineer.

One of the most difficult problems will be to keep the channels at Dayton and Hamilton in good condition. The deepening of the channel below its original bed has created a tendency for gravel and sand to be deposited in this depression. This tendency has been offset somewhat by improving the alignment of the channels. However the smaller streams, such as Mad River and Wolf Creek at Dayton, and Fourmile and Twomile Creeks at Hamilton, are known to bring down large amounts of gravel. To prevent as much of this material as possible from lodging in the improved channel, gravel plants have been located above the improvements on Wolf Creek and Mad River. These plants excavate gravel from the stream bed making a depression into which gravel will settle as it drifts downstream. Two small dams have been built on Wolf Creek to check the movement of gravel. At Hamilton a dam was built across the river at the upper end of the improvement. Above this dam is located the plant of the Hamilton Gravel Company which removed 31,500 cubic yards from the river during 1922. The Wolf Creek plant excavated 36,500 cubic yards during 1922. If it is considered that this amount of gravel might have to be removed annually from the improved channel it will be seen that a large expense is eliminated. A small revenue is derived from these plants by the District to compensate for the necessary inspection and control.

In spite of the fact that these gravel plants will remove large quantities, bars will form in the improved channels. These must be dealt with as they occur. In some cases where the gravel is of good quality and may be reached by teams it can be sold by the caretakers. In other cases the District may have to pay for having it removed when the proper time comes.

The formation of gravel bars and deposition of silt must be closely watched. Grass and weeds growing on the river bottom catch a surprising amount of silt, especially on the inside of curves. These deposits form so gradually that it is difficult to detect them by ordinary observation and cross sections must be taken to observe them accurately.

Willows and other brush must be removed from the channel and if possible their growth should be prevented. At present they are being either pulled up or cut with scythes and axes. Several experiments have been made with the purpose in view of exterminating the willows but so far with only slight success. If left to grow they would soon form a dense jungle over the entire river bottom. This would cause the deposition of large quantities of gravel and silt, forming bars, the removal of which would be very costly.

All of the lands in the retarding basins, except the permanent reserves, will eventually be in the hands of private owners, the District having flood easements and building restrictions on these lands. With a few exceptions no new buildings are permitted lower than 5 feet below spillway level, and old buildings are not allowed lower than ten feet below spillway. It will be the duty of the maintenance organization to make annually, a systematic inspection of all of these farms to see that the restrictions are complied with.

As stated above the principal difficulty lies in keeping tuned up for a flood which may not occur in several decades. At present the inhabitants of the valley still have vivid memories of the 1913 flood. Some of the men employed on the maintenance work have such memories and realize the importance of keeping flood protection works fit for maximum service. All of the men in the maintenance organization were employed on the works when they were under construction. These men have personal knowledge of the work and are familiar with conditions that need watching. In time, however, not only will they be replaced by others, but the Administration will change, flood dangers will be forgotten and the utmost vigilance on the part of those in charge will be necessary to keep the system always in readiness for a maximum flood.

Record of Conservancy Work in Drawings and Photographs

Complete History of the Construction Work in Picture and Plan.

It is very essential in planning and executing a construction project to make, prior to commencing the work, the necessary designs and working drawings. It is just as important to leave, when the work has been completed, a record showing how the structures were actually built. Changes of a major or minor nature are often made during construction, especially if the project involves the erection of structures of an unusual nature which are not standardized as to design.

On the Miami Conservancy project a large force of engineers and draftsmen were kept busy many months preparing and checking the plans for the construction of the works. Several thousand drawings were made and a considerable number of these were "working drawings", that is drawings which were taken to the field for use in laying out the work.

In order to have a record of all the structures of the District as actually built, the tracings of the working drawings were all carefully checked since the completion of the work and all revisions were noted on them in colored ink. After each drawing was checked and corrected it was labelled "Record Drawing," signed by the Chief Engineer, and filed away. There are over 400 of these record drawings; they constitute a complete and exact record of the manner in which all of the structures built by the District were made.

The value of a photographic record of the work was realized in the early stages of the project. Many pictures were taken which were of great assistance to the engineers in making the preliminary studies and final designs and plans. When construction work was started in 1918 it was found advisable to secure the services of an expert photographer, and throughout the construction period photographs were taken at all stages of the work.

The pictorial record is valuable from several aspects. In many cases, especially in the towns in the District, the improvement work was carried on through very valuable territory and the question of damage to adjoining properties was a real one. Wherever any structures were close enough to the proposed improvement to be affected by it, photographs were made showing conditions existent before any work was started. Then, in case damage claims were filed after the work was under way, evidence was available as to the original situation. This record has saved the District from the payment of unjust damage claims in several instances. In one case it was claimed that cracks had developed in the walls of a certain building close to a new retaining wall after the construction of the wall, showing that the new construction was responsible for settlement of the building. However, photographs taken of this building prior to the construction of the wall showed that the cracks existed at that time.

Photographs were made of structures which were, upon completion, to be partly or wholly hidden from view. These pictures furnish an indisputable record of the construction of these works.

Numerous pictures were taken from "strategic" points to show the progress of the work. A series of pictures were made from the same point at various stages of the work to show the gradual transition from original conditions to the final stage.

Photographs of equipment taken under working conditions have frequently been of material assistance in selling various parts of the construction plant.

In all some 4,000 negatives were made, all of the uniform size of seven by eleven inches. These negatives have been numbered and indexed for ready reference. A file copy of prints was prepared in the form of books, each containing all the photographs of a particular feature or unit of the project.

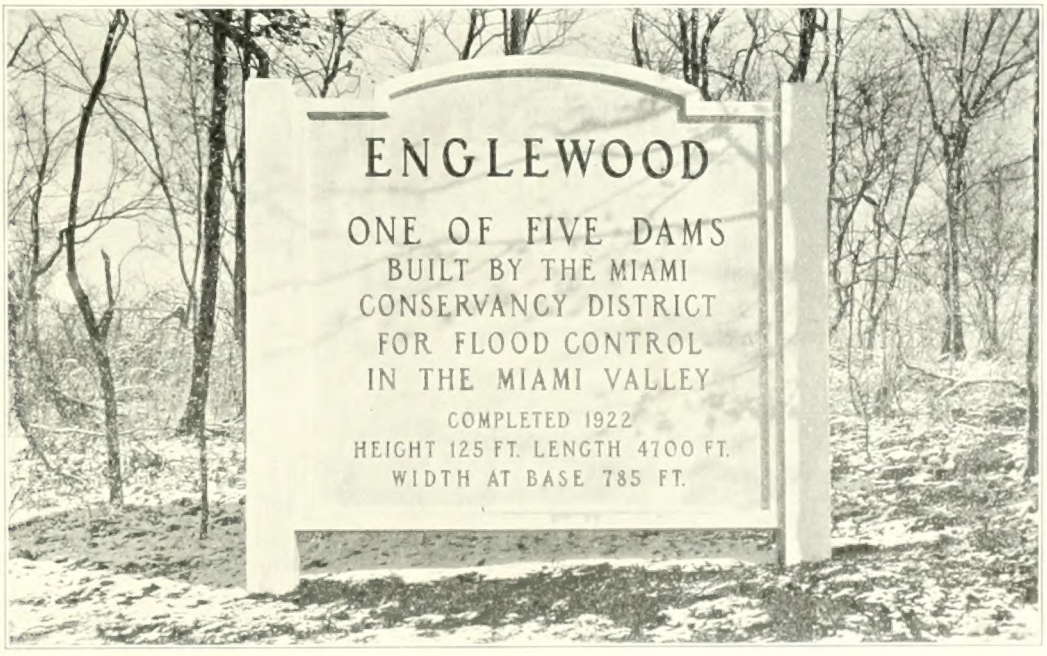

FIG. 405.—CONCRETE TABLET AT ENGLEWOOD DAM.
A similar tablet has been erected at each of the dams in a place easily seen by those who pass along the roads.
(See page 67 for further explanation.)

Engineering and Construction Personnel During the Construction Period

The list below includes the names of the men who were in responsible charge of the construction of the works of the District during the construction period, which extended from early in 1918 to late 1923. Some of these men served for only short periods, others were on the job from start to finish. It should be understood that this list does not include all engineering and construction employees; to attempt such a tabulation would take much more space than is available in this Bulletin. However, every one who was associated with the project, whether his name appears here or not, may feel that he has had a part in the creation of the largest purely flood control project in the country and has contributed his share in making the Miami Valley safe from disasters such as occurred in 1913.

General Engineering and Construction

Chief Engineer.—Arthur E. Morgan; Charles H. Paul.
Asst. Chief Engineer.—Charles H. Paul; J. H. Kimball.
Construction Engineer.—Charles H. Paul; J. H. Kimball.
Construction Manager.—Charles H. Locher.
Designing Engineer.—Walter M. Smith; R. M. Riegel.
Hydraulic Engineer.—G. L. Albert.
Office Engineer.—G. H. Matthes; C. N. Phillips; C. S. Bennett.
Field Engineer.—C. N. Phillips; J. F. Burkin; S. K. Young; C. S. Bennett.
Mechanical Engineer.—A. S. Robinson.
Engineer (Hydraulic Design and Data).—S. M. Woodward; G. H. Matthes.
Hydrographer and Flood Warning.—I. E. Houk.
Asst. Engineer (on Local Improvements).—E. C. Foust; W. M. Caye.
Master Mechanic.—Wm. McIntosh.
Chief Electrician.—Frank Harvey.
Engineer (Equipment and Salvage).—I. R. Bailey.
Chief Accountant.—O. K. Welker; F. L. Cavis; H. I. Lowman.
Purchasing Agent.—Fowler H. Smith.
Traffic Man.—W. T. Stockman.

Germantown Dam

Division Engineer.—A. B. Mayhew (died May 12, 1918); A. L. Pauls.
Asst. Div. Engr.—C. O. Shively.
Asst. Engr.—J. S. Bowman; A. Philpott.
Superintendent.—Albert Armstrong.

Englewood Dam

Division Engineer.—H. S. R. McCurdy.
Asst. Div. Engr.—H. W. Horne.
Asst. Engr.—J. L. Southworth; Kirby Jones; Myron Cornish; C. W. Howe.
Superintendent.—Richard Byers.
Asst. Supt.—R. L. Clark; Wm. Harrington.

Lockington Dam

Division Engineer.—Barton M. Jones.
Asst. Div. Engr.—C. H. Shea.
Asst. Engr.—W. J. Smith, Jr.; J. J. Loehr; W. R. Mounts; C. L. Zull.
Superintendent.—John Bolton; G. E. Warburton; W. D. Rogers (concrete).

Taylorsville Dam

Division Engineer.—O. N. Floyd.
Asst. Div. Engr.—V. P. Odoni; H. L. Freund.
Asst. Engr.—B. H. Petty; H. R. Daubenspeck; W. J. Smith, Jr.; C. O. Shively.
Superintendent.—H. M. Sherwood.
Asst. Supt.—D. C. Hager; Atolfo Claroni; W. D. Rogers (concrete).

Huffman Dam

Division Engineer.—C. C. Chambers.
Asst. Div. Engr.—I. E. Goodner (to Dec. 1918).
Asst. Engr.—J. S. Gena; C. L. Zull; J. W. Cullen.
Superintendent.—Verne Clawson.
Asst. Supt.—J. R. Cook; P. W. McGinnis.

Dayton

Division Engineer.—C. A. Bock.
Asst. Div. Engr.—E. L. Chandler.
Asst. Engr.—R. B. Clement; H. L. Rogers; C. W. Ullom; J. E. Everhardt; E. J. Ries; Kirby Jones; W. L. Sylvester; C. L. Zull; F. G. Blackwell.
Superintendent.—H. A. Hanson.
Asst. Supt.—V. H. Tucker; S. U. Stine.

Hamilton

Division Engineer.—C. H. Eiffert.
Asst. Div. Engr.—R. B. McWhorter.
Asst. Engr.—J. E. Faist; G. W. Schrader; C. H. Schwartz; J. S. Gena.
Superintendent.—W. T. Rains; Wm. Roush (concrete); F. C. Williams (sewers).
Asst. Supt.—J. D. Allen.

Railroad Relocations

Division Engineer.—E. N. Floyd; Albert Larsen.
Asst. Engr.—W. D. Kramer; O. Froseth; W. E. Duckett; W. R. Yount; C. W. Howe; J. K. Cochran; L. F. Wilcock; S. Rice.
Superintendent.—F. H. Sprague (concrete); Leslie Wiley (concrete).

Piqua

Asst. Engineer.—Albert Schroeder.
Superintendent.—Thos. Nagle.

Troy and Tipp City

Division Engr.—A. F. Griffin.
Asst. Engr.—G. N. Burrell (concrete); E. J. Ries; E. W. Lane.
Superintendent.—W. D. Rogers (on Adams St. Bridge); Robt. Reynolds.

Miamisburg, Franklin, Middletown, W. Carrollton

Division Engineer.—F. G. Blackwell.
Asst. Engr.—W. L. Sylvester; G. N. Burrell; J. P. Keckler.
Superintendent.—Albert Armstrong.

River Conditions in 1923

(Continued from Page 75.)

inches of rain fell in December; this is 4.22 inches more than the normal amount for this month. December rains furnished the highest river stage of the year, the gage at Dayton recording 8.30 feet on the 14th. No high water was experienced in the spring; the highest stage at Dayton was 6.90 feet, on May 17th. It should be remembered in this connection that the river gage at Dayton was lowered 2.73 feet in December, 1922, so that a stage of 6.90 feet represents a stage of only 4.17 feet under the old conditions. It was necessary to lower the gage because in the dry season the stages fell below the zero of the gage. The lowest recorded stage of the river at Dayton for 1923 was 0.48 feet on August 24th. It is probable that the river fell still lower in October and November, but some temporary construction work in the river channel several hundred feet below the Main Street bridge so affected the stage that it was not possible to get accurate readings during those months.